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EP 0777227 A1   US 5619731 A

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(54) Abstract Title
Optical storage disc storing compressed and uncompressed data

(57) An optical storage disc, for example a Compact Disc (CD) or Digital Video Disc (DVD), has stored thereon a first set of data comprising audio data for playback by an optical storage disc player system, and a second set of data comprising a compressed version of the same audio data. The compressed version can thus be downloaded directly from the disc to another storage medium, for example a solid state audio player system, which has the ability to decompress the data. The second set of data may further comprise interactive multimedia data and may also be encrypted. Details of the compression and encryption algorithms may be stored on the disc. The same CD (or DVD) can also be used for normal playback of the audio data in a conventional CD or DVD player.

Fig. 6

2.77cm   0.72cm
0.26cm
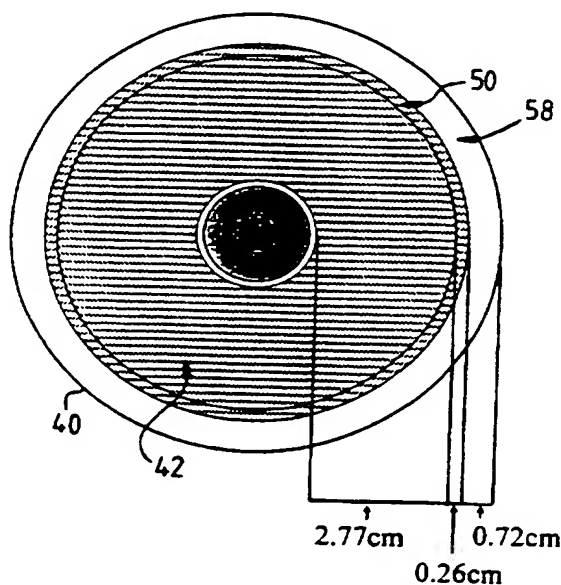
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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.
The claims were filed later than the filing date but within the period prescribed by Rule 25(1) of the Patents Rules 1995.
This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995
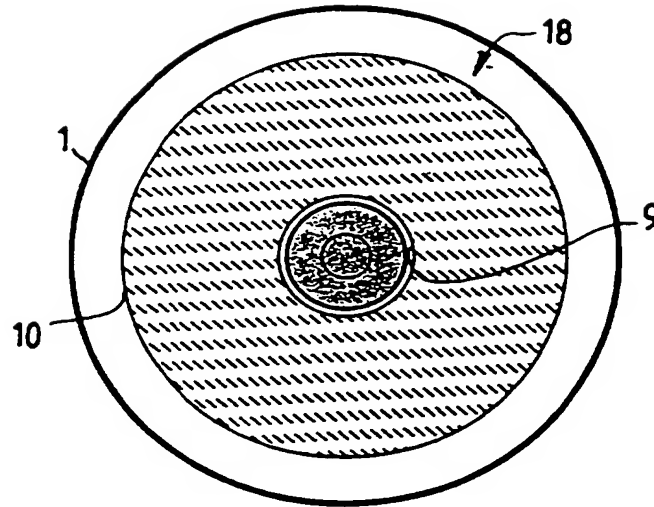The print reflects an assignment of the application under the provisions of Section 30 of the Patents Act 1977.
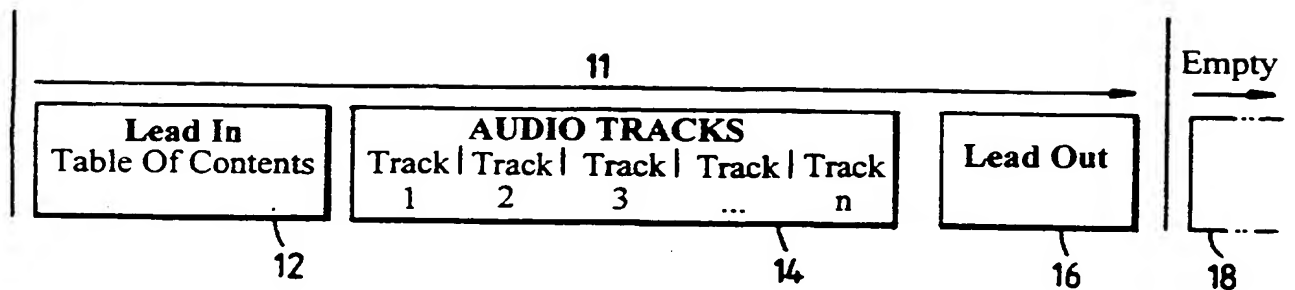
Fig. 2

| Lead In
Table Of Contents | AUDIO TRACKS
Track 1 \| Track 2 \| Track 3 \| Track ... \| Track n | Lead Out | Empty |

Fig. 3

44

CD *Session* Layout

| Lead In | Audio | Lead Out | | Lead In | Compressed Audio | Lead Out | | Empty |

48 **52** **54** **56**

46

Session 1

42 **50** Session 2

58

Standard CD-ROM player with additional firmware to read the proposed compressed audio, within a product so configured to download said compressed audio.

65

Compressed Audio

Interface Hardware — **63**

MEMORY DRAM/FLASH — **60** **61**

DECODER (Programmable) — **62**

Compression Type Encryption type
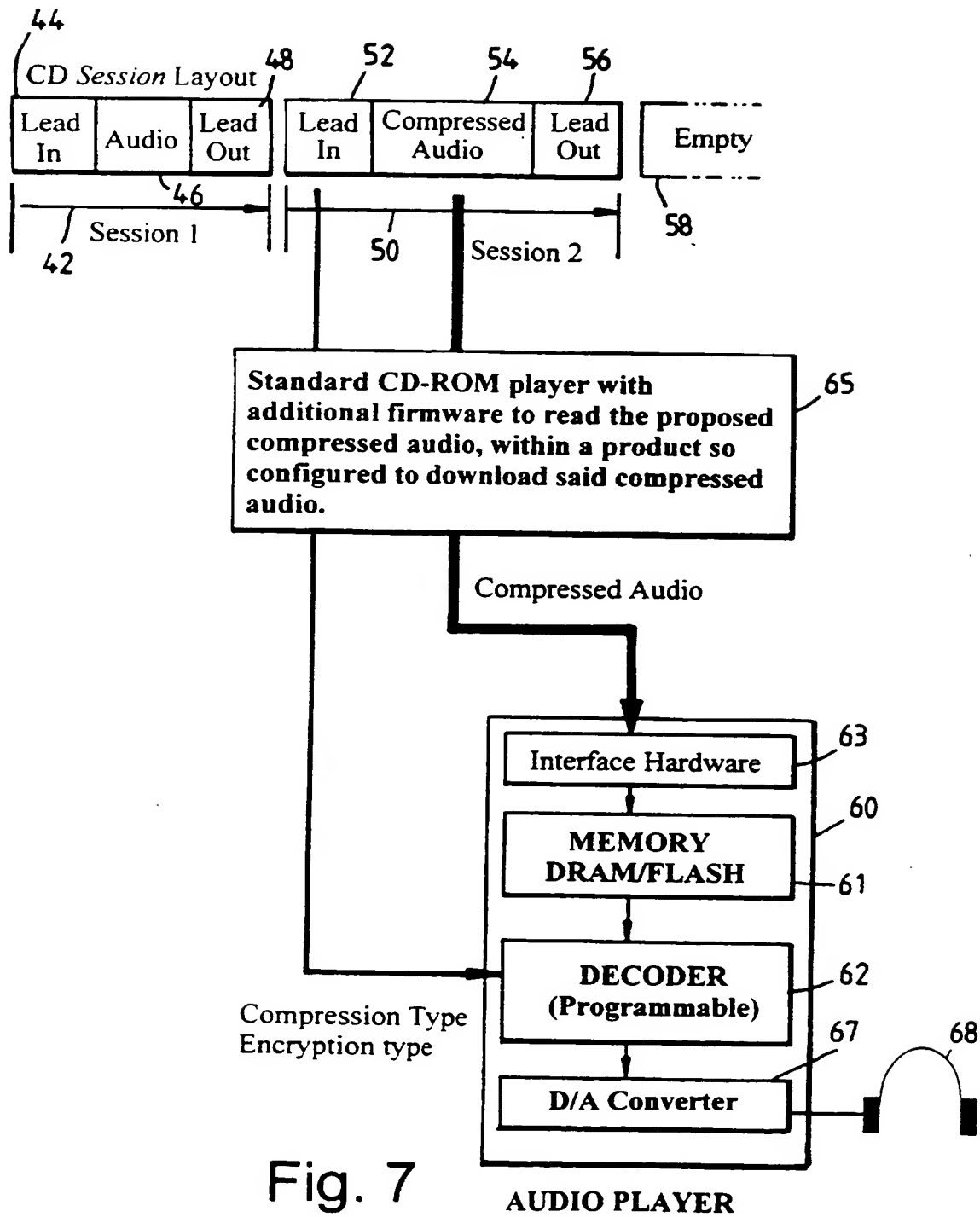
D/A Converter — **67** **68**
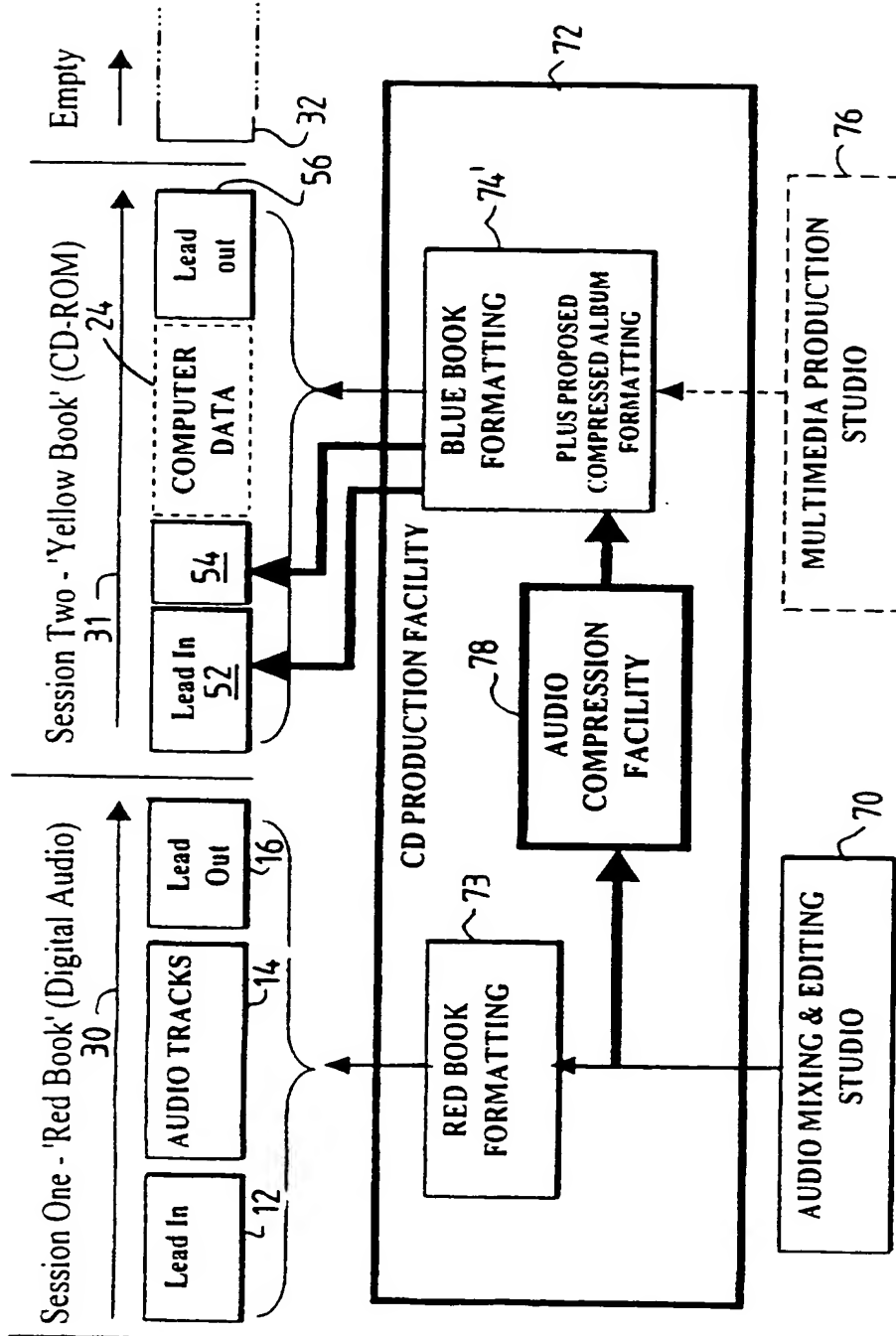
Fig. 7

AUDIO PLAYER

Fig. 9

the audio data is read directly from the CD and compressed

using a compression algorithm, such as MPEG, in the PC, where

the data can be stored in a file with a compression factor

ranging from 4:1 to 24:1. Once the compression is carried

5 out, the file is then transferred to the target solid state

memory device, which could for example, be a removable solid

state memory card (which may be inserted in another PC or

audio player system), or a solid state audio player system

designed to interface with the PC, for example via a docking

10 station. In order to decode the data for audible listening,

decompression is required. Decompression is normally carried

out in real-time, in the player system, as the compressed data

is read from the storage medium. Fig. 1 illustrates such a

known system in which audio data is downloaded from a CD 1 to

15 a PC 2 which carries out the necessary data compression using

compression software loaded into the PC for this purpose. The

compressed audio is downloaded to a solid state audio player

device 4, via a docking station 3. The downloaded data is

stored in DRAM or FLASH memory 5 in the player device which

20 also incorporates decoder means 6 for decompressing the audio

data, and a D/A convertor 7 for converting the digital data to

analogue form for playback to the user, via headphones 8.

The audio data in said first set of data preferably comprises an album of music tracks, whereby said second set of data comprises a compressed version of the whole album.

5 The optical storage disc may comprise a first session consisting of a first lead in, said first set of data and a first lead out, and a second session consisting of a second lead in, said second set of data, and a second lead out. The disc may further include additional data, such as computer-

10 executable interactive multimedia data.

Alternatively, the optical storage disc may be a single session disc where said first set of data is stored thereon as a number of audio tracks in a single session and said second

15 set of data is stored as an additional track in the session, the session further including a lead in and a lead out.

Preferably details of the compression algorithm used to compress the audio data are also stored on the optical storage

20 disc, preferably in a lead in of a session which contains said second set of data. Audio player systems which are to be used for playback of the compressed data would be provided with means for reading and recognising these stored details of the

Preferred embodiments of the invention will now be described

by way of example only and with reference to the following

drawings in which:

Fig. 1 is a schematic diagram illustrating a prior art

5 process for storing compressed audio onto solid state memory;

Fig. 2 is a schematic plan view of a conventional CD;

Fig. 3 is a block diagram illustrating schematically the

content of a conventional single session CD;

Fig. 4 is a block diagram illustrating schematically the

10 content of a conventional CD-ROM;

Fig. 5 is a block diagram illustrating schematically the

content of a conventional multi-session ("Blue Book") CD;

Fig. 6 is a schematic plan view of a new CD according to the

invention;

15 Fig. 7 is a schematic diagram illustrating high speed

download of audio data using a CD according to Fig.6;

Fig. 8 is a block diagram illustrating schematically the

production processes used to produce a "Blue Book" type CD;

and

20 Fig. 9 is a block diagram illustrating schematically the

production processes used to produce the CD of Fig. 6

according to one embodiment of the invention.

Fig. 6 shows a new CD 40 according to one embodiment of the invention. As illustrated in Figs. 6 and 7 this CD contains a first session 42 ("session 1") comprising a lead in 44, digital audio tracks 46, and a lead out 48. Session 1 (42) is

5 conventional Red Book. In addition, the CD 40 contains a second session 50 ("session 2") consisting of a lead in 52, a compressed version 54 of the digital audio tracks 44 in the Red Book session, and a lead out 56. The remaining space 58 on the CD is empty.

10 On a typical CD Album, around 50 minutes of uncompressed audio data is stored (about 504Mbytes of data). An additional 50 minutes of CD quality MPEG layer 3 compressed audio can be stored easily (approximately 47 Mbytes at 128Kbits/second) in the recording space left on the CD after the uncompressed

15 audio data. Typically, as shown in Fig. 6 the Red Book session 42 comprises 2.77 cm of the full radius of the CD, while the new session 50 would comprise 0.26 cm of the full radius of the CD, with 0.72 cm of the radius, at the outer edge portion of the CD, remaining empty. The maximum album

20 capacity is normally 74 minutes for a standard CD. The compression ratio used will determine the maximum amount of uncompressed data which may be fitted on the disc. For example, using CD quality MPEG Layer 3 (with a compression

formatting process 73 takes place in a CD production facility
72, to produce the Red Book Session 30 on the CD. Blue Book
formatting 74, to produce the Yellow Book Session 31 on the
CD, also takes place in the CD production facility 72, using
5 input data obtained in a multimedia production studio 76 in
which creation of multimedia software designed to run on a PC
(having been read off the CD by a CD-ROM drive) takes place,
e.g. incorporating band pictures/videos/lyrics/games.

Fig. 9 illustrates how the conventional Blue Book production
10 process can be modified to produce the new CDs. Like
components/blocks to those in Fig. 8 are referenced by like
numbers. In this case, a modified Blue Book process 74 is
used to produce the second session 50 in the new CD in which
the compressed version 54 of the audio data 14 from the Red
15 Book session is stored onto the CD. This modified Blue Book
formatting 74 may also include formatting the conventional
multimedia interactive computer data component 24 (from the _
multimedia production studio 76) onto the CD in the same
session 50 as the compressed audio. The compressed audio is
20 produced, following the audio mixing and editing studio 70
process, using an audio compression facility 78 provided in
the CD production facility 72. It will be appreciated that
the audio compression technique, and compression algorithm

In the embodiment of Figs. 6 and 7, the compressed data 44 is also encrypted and the lead in 52 of the second session 50 also includes details of the encryption algorithm that has been used. The audio data can only be decompressed and read

5 by a solid state audio player that recognises the type of encryption used. The encryption can thus be used to control the copying of data from the CD to another digital storage medium.

One way of effectively encrypting the data is to use a

10 compression format which is non-standard, i.e. a slightly modified version of MPEG. This serves as an encryption method since the data cannot be read easily unless the appropriate decompression method is known. Alternatively, an encryption method based on the Data Encryption Standard (DES), with the

15 key hidden in the Lead-in 52, could be implemented.

Another situation in which the new CD may be produced, in addition to the production at industrial manufacturing/duplication sites, is in networked music distribution where one mode of delivery is through using

20 recordable CD-ROMs. Buyers purchase individual tracks which are then recorded onto CD, labels printed etc. This can be carried out at dedicated stations in shops, or even carried out at home. Buyers could be allowed to create their own

programmed with appropriate software/firmware. Alternatively,
an "audio dubbing station" as described in our pending UK
Patent Application No. 9825338.8 could be
programmed/configured to read and download the compressed
5 version 54 of the audio from the CD 40.

The transfer of the compressed audio data 54 can be carried
out at high speed, much greater than real time, and may, for
example be transferred at greater than 10 times real-time. By
way of an example, if the compression algorithm compresses the
10 audio data 46 by a factor of 12 and the download from the CD
is carried out at 24 times speed (24 times faster than CD-DA
Red Book audio playback rate), the total speed to transfer the
compressed digital audio data 54 will be 12 x 24 = 288 times
faster than real-time. Thus an audio session (uncompressed)
15 with a real time duration of 60 minutes, can be transferred to
the solid state memory in 12.5 seconds (assuming that the data
can be written to the solid state memory 61 at an appropriate
data rate).

Details of the compression algorithm used can be stored in the
20 lead in 52 of the second session 50, and can be recognised by
an audio player system programmed to read and recognise that
compression algorithm. A programmable decoder 62 within the
audio player 60 can be programmed to decode the type of

the scope of the invention. For example, instead of storing

the compressed audio in a separate session on the CD it could

be stored as a separate "track" in the Red Book session on the

CD.

5 The solid state memory to which the compressed audio is

downloaded could be a removable FLASH memory card for

insertion in a PC, audio dubbing unit or solid state audio

player system.

It will also be appreciated that the present invention is

10 applicable not only for conventional audio CDs, but for other

optical disc formats too e.g. DVD, CD-Recordable and CD-

ReRecordable formats. In each case the new disc would contain

a set of audio data for playback in a CD player system, and a

second set of data comprising a compressed version of the same

15 audio data.

6. An optical storage disc according to claim 5, having additional data stored thereon.

7. An optical storage disc according to claim 6, wherein said
5 additional data comprises computer-executable interactive multimedia data.

8. An optical storage disc according to any of claims 1 to 4, wherein disc is a single session disc where said first set of
10 data is stored thereon as a number of audio tracks in a single session and said second set of data is stored as an additional track in the session, the session further including a lead in and a lead out.

15 9. An optical storage disc according to any preceding claim, wherein details of a compression algorithm used to compress the audio data are also stored on the optical storage disc.

10. An optical storage disc according to claim 9, wherein said
20 details of the compression algorithm are stored in a lead in of a session which contains said second set of data.

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Claims searched:	1-15	**Date of search:** 12 April 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

  UK Cl (Ed.R): G5R (RAC), (RAD), (RGA), (RB24D), (RB27), (RB885)

   Int Cl (Ed.7): G11B 7/007, 7/013, 20/00

Other: Online: EPODOC. WPI, PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	EP 0777227 A1 (SONY) (see abstract and col.3 lines 15-53 and claim 5)	1-8,10-15
X	US 5619731 (ARDENT TELEPRODUCTIONS) (see abstract and col. 4 lines 7-20)	1-8, 10-15

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.